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Magnetic Resonance Imaging / Formation image de résonance magnétique

A Day in the Life of MRI: The Variety and Appropriateness of Exams Being Performed in Canada

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Abstract

Purpose: This study aimed to determine the volumes and types of magnetic resonance imaging exams being performed across Canada, common indications for the exams, and exam appropriateness using multiple evaluation tools.

Methods: Thirteen academic medical institutions across Canada participated. Data were obtained relating to a single common day, October 1, 2014. Patient demographics, type by anatomic region and indication for imaging were analysed. Each exam was assessed for appropriateness via the Canadian Association of Radiologists Referral Guidelines and the American College of Radiology Appropriateness Criteria. The Alberta and Saskatchewan spine screening forms and the Alberta knee screening form were also used where applicable. The proportion of exams that were unscorable, appropriate, and inappropriate was determined. Exam-level results were compared between the 2 main evaluation tools.

Results: Data were obtained for 1087 relevant exams. There were 591 women and 460 men. 36 requisitions did not indicate the patient's sex. Brain exams were the most common, comprising 32.5% of the sample. Cancer was the most common indication. Overall, 87.0%–87.4% of the MR exams performed were appropriate; 6.6%–12.6% were inappropriate, based on the 2 main evaluation tools. Results differed by anatomic region; spine exams had the highest proportion, with nearly one-third of exams deemed inappropriate.

Conclusion: Variations by anatomic region indicate that focused exam request evaluation or screening methods could substantially reduce inappropriate imaging.

Résumé

Objet : L'étude vise à définir le nombre et le type d'examen d'imagerie par résonance magnétique réalisés à l'échelle du Canada, les indications qui motivent couramment les examens et la pertinence des examens au moyen de plusieurs outils d'évaluation.

Méthodes : Treize centres médicaux universitaires du Canada ont participé à l'étude. Les données recueillies ont toutes porté sur la même journée, à savoir le 1^{er} octobre 2014. L'analyse a examiné les caractéristiques démographiques des patients, le type d'examen selon la région anatomique et l'indication qui a motivé l'examen d'imagerie. Les *Lignes directrices relatives aux demandes d'examen en radiologie de l'Association canadienne des radiologistes* et les critères de pertinence de l'American College of Radiology ont servi à évaluer la pertinence de chaque examen. Les formulaires de tri pour les examens du rachis en Alberta et en Saskatchewan et le formulaire de tri pour les examens du genou en Alberta ont aussi été utilisés, s'il y avait lieu. La proportion d'examen pertinents, d'examen non pertinents et d'examen auxquels il a été impossible d'attribuer une note a été calculée. Enfin, les résultats à l'échelle de l'examen obtenus au moyen des deux principaux outils d'évaluation ont été comparés.

Résultats : Des données ont été recueillies à l'égard de 1 087 examens pertinents. Ces examens ont été réalisés chez 591 femmes, 460 hommes et 36 patients de sexe inconnu (sexe non indiqué dans la demande d'examen). Les examens les plus courants, qui représentaient 32,5 % de l'échantillon, portaient sur le cerveau, tandis que l'indication la plus courante visait le cancer. De manière générale, de 87,0 à 87,4 % des examens d'IRM réalisés étaient pertinents, contre 6,6 à 12,6 % des examens qui ne l'étaient pas, selon les deux principaux outils d'évaluation. Les résultats ont varié selon la région anatomique. Les examens du rachis ont affiché la plus grande proportion d'examen jugés non pertinents, soit près du tiers des examens.

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Conclusion : Les variations à l'échelle de la région anatomique révèlent que l'adoption de méthodes d'évaluation ou de tri ciblées pour les demandes d'examen pourrait considérablement réduire le nombre d'examens d'imagerie non pertinents.

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Key Words: Appropriateness; Appropriateness criteria; Appropriateness guidelines; Magnetic resonance imaging; Radiology departments

Technological advancements and expanded applications have dramatically expanded the role of medical imaging over the past 2 decades. However, with increasing demand, patient access to equipment and appropriately trained personnel has become more limited. Physicians and radiologists are being urged to be wise stewards of these valuable resources [1] by limiting inappropriate use [2]. To help guide and evaluate medical imaging use and exam appropriateness, organizations such as the Canadian Association of Radiologists (CAR) and the American College of Radiology (ACR) to develop criteria or guidelines for imaging appropriateness.

Many previous studies have evaluated these appropriateness assessment tools. Some focused on select indications such as lower back pain [3,4] or specific exam types including cardiac [5], knee [6,7], lumbar spine [8], and breast [9,10] exams. Others have studied particular settings such as emergency departments [4,11] or specific patient populations, including lymphoma [12] or pediatric patients [13]. Siström et al applied an electronic decision support tool based on the ACR Appropriateness Criteria (ACR-AC), ACR Select [14], more broadly to evaluate all types of computed tomography (CT), magnetic resonance (MR), and nuclear medicine exams in an American hospital between 2008-2012. They found that cardiac and chest exams had the highest rates of inappropriate imaging, at 7.8% and 7.5%, respectively [15]. In contrast, Lehnert and Bree [16] used a propriety program, HealthHelp, in their study of CT and MR exams performed between June and November 2007 in a university hospital primary care setting in the United States and found the highest rates of inappropriate MR exams occurred for shoulder and spine exams, at 37% and 35%, respectively.

In Canada, such research has been more limited. A recent review of MR appropriateness studies found results ranging from 2% inappropriate studies across brain, lumbar spine, and knee exams in one study to 28.5% of spine exams in another [17]. Such differing results stem from differences in study design, location, patient populations, evaluation tools, and anatomic regions studied. These differences make it difficult to compare results among studies, while also highlighting that rates of inappropriate imaging differ among patient and exam cohorts.

In this study, we aimed to capture a snapshot of MR exam activity across Canada in academic settings by conducting a national, multisite study over a single 24-hour period. We determine the overall volumes and types of MR exams being performed across Canada and the most common indications motivating these exams. We investigate each indication for MR imaging (MRI) referral evaluating its appropriateness using some of the more widespread and relevant guidelines

and screening tools available in North America. Multiple exam appropriateness assessment tools are applied to provide a more in depth estimates of exam appropriateness and to gain insight into differences among appropriateness tools, particularly regarding cases in which they yield conflicting conclusions. We also identify exam types that may not be evaluable with current tools and why, and compare the usability of the evaluation tools. Understanding current MRI usage, exam appropriateness, and assessment tools not only aids patients and practicing radiologists but also provides insight into the knowledge radiology residents need as they prepare to enter practice in a rapidly advancing field.

Methods

An invitation to participate in this study was sent to all 16 academic medical centres offering Medical Imaging residency programs across Canada. Research Ethics Board approval was obtained from each participating site. Participating institutions were asked to provide a liaison to collect and submit the study data to our research team.

Data

Information acquired from each site included facility-level information obtained via survey and exam-specific information relating to all exams completed within a common single 24-hour period.

The facility-level survey was completed either in hard-copy or softcopy (provided as a Microsoft Word [Microsoft Corporation, Seattle, WA, USA] document) or online using FluidSurveys (<http://fluidsurveys.com>). Facility details collected included institution identification, number of operating MR scanners, and magnet strength, as well as imaging centre operating hours. Sites were also asked to submit a blank exam referral form. MR facility operational results were collected and analysed by our research team and were previously published [18].

The exam-level data collection involved submitting the request forms for all exams completed within the specified 24-hour period without any patient identifying details. Additional details, if not included the request forms, were also to be submitted. These details included the prioritization level, as per the institution's exam scheduling urgency categories where applicable, use of contrast, the requirement for sedation or anesthesia, and whether the exam was completed or not.

For institution-level results, the identities of participating institutions were anonymized based on a randomly assigned number consistent with our previously published work [18].

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